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TERTIARY SPORE AND POLLEN ASSEMBLAGE FROM NEYVELI LIGNITE FORMATION, TAMIL NADU, INDIA

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ABSTRACT

The Tertiary system in Southern India is divided in to the Upper Cuddalore formation and the Lower Neyveli formation. The lignite fields of Neyveli region comes under the Neyveli formation. The present report is about the observation of some spores of Pteridophytes and pollen grains of some Gymnosperms and Angiosperms from the Neyveli lignite formation. Tamil Nadu, India. From the observation of lignite samples it was concluded that the Neyveli formation was deposited during Tertiary (Miocene) period and the vegetation prevails during the time of deposition was tropical wet evergreen forest type.

Key words: Palaeoenvironment, Microfossils, Neyveli lignite, Tertiary.

1. INTRODUCTION

The sedimentary rocks of the Tertiary age exposed from Pondicherry in the North to Rameswaram in the South, along the coast were divided in to two formations viz. the Upper Cuddalore formation and the Lower Neyveli formation (Siddhanta, 1986). The Neyveli formation contain lignite seam of 15 meter thick. There are three distinct clay beds above the lignite which are faintly continuous and extensive. Megascopically, the lignite is banded, massive and compact in appearance. The lignite appears to be either woody, amorphous or coaly. Microscopical observation of lignite sample shows, woody and non-woody tissues of different plants, spore – pollen exines, cuticles of leaves, resins, fungal spores and sclerotia (Navale,

1968). The physical components of lignite grouped under Huminite (woody and non-woody tissues, detritus and gel); Leptinite (spores, pollens, cuticles, resins, etc); and Inertinite (fused organic substances) (Navale, 1968). Saxena, (1992) Published a broad report on the pollen and spores reported so far from the Neyveli lignite formation. Although many publications came out on the pollen and spore content of Neyveli lignite formation, the present study is significant in the way it contains many new reports of pollen and spores from this formation.

2. MATERIALS AND METHODS

The material consists of ten samples from Mine-II (Plate-1) area. The lignite occurs between the depths of 115.0m—128.0m. For the recovery of Palynomorphs, samples treated with concentrated nitric acid. After oxidation the residue was repeatedly washed with water and then treated with 3–6 % of KOH solution. Slides were prepared in glycerine jelly. Morphological characters of the palynomorphs were studied and photographed using Olympus microscope attached with Olympus digital camera.

3. OBSERVATION

The following spores and pollen grains were observed in the present study.

I. *Schizaeisporites eocenicus* (Selling) Potonie (Pate. 2, Fig. 1)

It is a Pteridophyte spore and it is bean shaped, 32 x 21 μm in size, extending to half of the longer axis, exine 1.6 μm thick and finely striated on both surfaces, sexine 2.5 μm thick.

Comparison

So far, 16 species of *Schizaeisporites* were reported from the Tertiary sediments of India. Out of these ten species (*S. crassimurus*, *S. digitatoides*, *S. eocenicus*, *S. ghoshii*, *S.*

grandiformis, *S. grandistriatus*, *S. minimus*, *S. perforatus*, *S. phaseolus*, *S. sinuata*) were reported from the Neyveli formation and adjoining Tertiary deposits of South India. The present species *S. eocenicus* already reported from this formation (Siddhanta, 1986).

II. *Ornatetradites droseroides* Rao & Ramanujam (Pate. 2, Fig. 2,3)

It is a Pteridophyte spore and it is found as tetrahedral tetrad and the tetrad is 30×35µm in size with trilete marking.

Comparison

So far five species of *Ornatetradites* (*O. chandae*, *O. droseroides*, *O. keralensis*, *O. microgranites* and *O. wellmanii*) reported from various Tertiary deposits of India (Kumar *et al.* 2001). But so far no species have been reported from the Neyveli formation. This is the first report of this species from the Neyveli formation.

III. *Araucariacites australis* Cookson ex Couper (Pate. 2, Fig. 4)

It is pollen of Araucariaceae. Pollen flattened circular, radially symmetrical, 39–93µm in diameter, not saccate. Exine 1.0 µm thick, sculptured with fine grana.

Comparison

Pollen of Araucariaceae (*Araucariacites*) so far reported from the Upper Jurassic–Lower Cretaceous sediments. There are only two species *Araucariacites* (*A. australis* and *A. masolensis*) reported in the Tertiary deposits of India. This is the first report *Araucariaceae* pollen from this formation. Pollen of Podocarpaceae (*Podocarpidites*) also reported from this formation (Jeyasingh *et al.*, 1989). Apart from these many petrified woods of Araucariaceae and Podocarpaceae were also reported from the Upper Cuddalore sandstone formation. This indicates

the Tertiary vegetation of this region normally contain a good number of gymnosperm representatives.

IV. *Grevilloideaepites eocenicus* Biswas (Pate. 2, Fig. 5)

Pollen triangular–sub triangular in polar view with a circular central body and three projecting arms, Pollen $30 \times 65 \mu\text{m}$, without apertures, arms $10\text{--}30 \mu\text{m}$ long and $10.2 \mu\text{m}$ broad, sexine granular, forming negative reticulum, more pronounced and specially concentrated at the base of the arms, nexine in the pollen body is $2\text{--}3 \mu\text{m}$ thick.

Comparison

This pollen related to pollen of Proteaceae. So far four species *Grevilloideaepites* (*G. eocenicus*, *G. inferius*, *G. pachyexinus* and *G. trilobatus*) reported from Tertiary deposits of India. Out of these four species *G. eocenicus* is the common species found in most of the Tertiary deposits of India. It was also observed in Neyveli lignite formation (Singh & Misra, 1991). The present investigation gives additional evidence for the occurrence of this species in this formation.

V. *Meliapollis firmus* (Sah) Navale & Misra (Pate. 2, Fig. 6)

Pollen quadrangular in polar view, $80 \times 84 \mu\text{m}$ in size, tetracolporate, colpi medium to long, margin thickened, pore circular to lalongate, surface psilate.

VI. *Meliapollis iratus* Sah & Kar (Pate. 2, Fig. 7)

Pollen quadrangular, $66\text{--}90 \mu\text{m}$ in size, tetracolporate, colpi long, margin thickened, exine $3\text{--}4 \mu\text{m}$ thick, sexine thinner ($1.5\text{--}3.0 \mu\text{m}$) than nexine, surface laevigate.

VII. *Meliapollis navalei* Sah & Kar (Pate. 2, Fig. 8)

Pollen subcircular to pentagonal, 50–52 μm in size, pentacolporate, brevicolporate, colpi faintly seen, lalongate, 6–7 μm in diameter with thickened margins, exine 6–7 μm in thick, surface laevigate.

VIII. *Meliapollis quadrangularis* (Ramanujam) Sah & Kar (Pate. 2, Fig. 9)

Pollen almost circular in polar view, 36×38 μm in size, tetracolporate, colpi medium to long, exine thick and surface psilate.

IX. *Meliapollis ramanujamii* Sah & Kar (Pate. 2, Fig. 10,11,12,13)

Pollen subcircular–circular, 52×57 μm , tetracolporate, colpi medium, faintly visible, pore circular, lalongate, margin thickened, amb square, 6.0 μm across, exine 1.6–2.6 μm thick, surface laevigate.

X. *Meliapollis tamilii* Navale & Misra (Pate. 2, Fig. 14)

Pollen sub circular to pentagonal, 110×130 μm in size, pentacolporate, brevicolporate, colpi faint, lalongate, with thickened margins, exine 4.0–6.6 μm thick, sexine slightly thinner than nexine, surface laevigate.

Comparison

The pollen of the genus *Meliapollis* is very much similar to the pollen of extant Meliaceae members. So far 13 species of *Meliapollis* reported from the various Tertiary deposits of India. Most of these species (11) were reported from the Neyveli lignite formation (Rao, 2000). Only two species viz. *M. minutes* and *M. quilonensis* were not so far reported from this formation. This observation shows that many members of Meliaceae were present in the Tertiary vegetation of this area.

XI. *Polygonacidites frequens* Sah & Dutta (Pate. 2, Fig. 15)

Pollen of Polygonaceae affinity. Pollen prolate spheroidal, 35–40 μm ×38–45 μm in size, tricolporate, colpi long, exine thick, columellate, columella broader towards the poles, surface broadly reticulate.

Comparison

So far two species *Polygonacidites* (*P. frequens* and *P. zonoidies*) reported from the Tertiary deposits of India. Recently Mandaokar and Mukherjee, (2014) reported this fossil pollen from Panruti region (Cuddalore sandstone formation). This is the first report of this species from the Neyveli lignite formation.

XII. *Tamilipollenites robustus* Singh & Misra (Pate. 2, Fig. 16)

Pollen circular in polar view, 114–120 μm in size, pentacolporate, colpi medium to long, margin thickened, pore circular to lalongate with thickened margins, exine 4.0–6.6 μm thick, sexine slightly thinner than nexine, surface laevigate.

Comparison

So far two species (*T. grandis* and *T. robustus*) of *Tamilipollenites* reported from Neyveli lignite formation and these species so far not been reported from other Tertiary sediments of India.

4. DISCUSSION

Pollen reported so far from the Neyveli lignite formation are comes from the angiosperm families such as *Araliaceae*, *Aquifoliaceae*, *Brassicaceae*, *Caprifoliaceae*, *Lamiaceae*, *Haloragaceae*, *Hippocreteaceae*, *Liliaceae*, *Meliaceae*, *Myricaceae*, *Myrsinaceae*, *Nyssaceae*,

Olacaceae, Oleaceae, Polygonaceae, Potamogetonaceae, Rhamnaceae, Rubiaceae, Santalaceae, Symplocaceae. Apart from these, fruiting bodies and spores of Microthyriaceous fungi, spores of Pteridophytes, and Gymnosperms also observed in the lignite samples, but they are poorly represented. This pollen flora suggest a tropical–humid climate with higher rainfall during the time of sedimentation. In general, the Tertiary floristic components of South India clearly indicates the occurrence of discrete pockets of brackish water or estuarine mangrove swamps adjacent to the coastline and tropical wet ever green forest slightly away from it (Ramanujam, 1982). The observation of pollen grains also suggest that the main lignite seam is mainly composed of angiosperm dominant vegetation during the time of deposition. The similar palynomorphs encountered in all three mines of Neyveli lignite shows that there is no signification difference in the vegetation and palaeoecology of these three areas.

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